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UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF CALIFORNIA

TIGO ENERGY INC.,

Plaintiff,

vs.

SUNSPEC ALLIANCE,

Defendant.

Case Number: 3:23-cv-00762-WHO

FIRST AMENDED COMPLAINT FOR PATENT INFRINGEMENT

DEMAND FOR JURY TRIAL

COMPLAINT

Plaintiff Tigo Energy Inc. ("Tigo") brings this First Amended Complaint for patent infringement against Defendant SunSpec Alliance ("SunSpec") and alleges as follows:

THE PARTIES

1. Tigo is a Delaware corporation, having its principal place of business at 655 Campbell Technology Pkwy., Campbell, CA 95008.

2. On information and belief and according to the records of the California Secretary of State website, SunSpec is a nonprofit corporation organized and existing under the laws of California with a principal place of business at 4040 Moorpark Avenue, Suite 110, San Jose, CA 95117.

JURISDICTION AND VENUE

3. This action arises under the patent laws of the United States, Title 35 of the United States Code. Accordingly, this Court has exclusive subject matter jurisdiction over this action under 28 U.S.C. §§ 1331 and 1338(a).

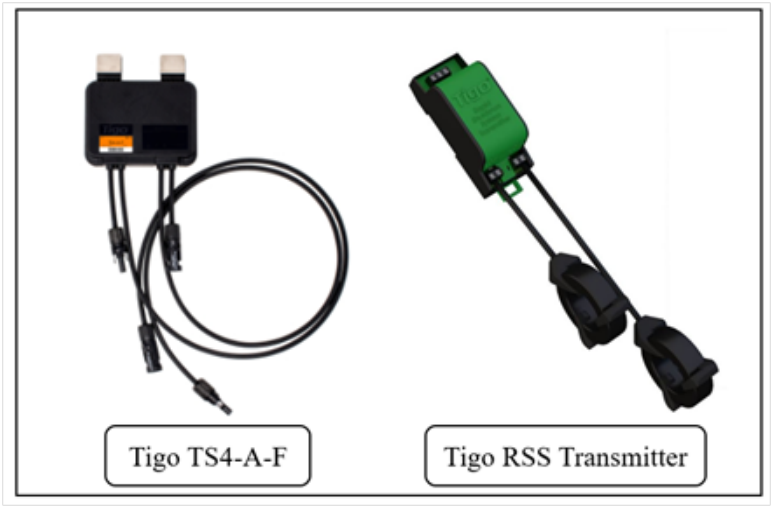
4. This Court has personal jurisdiction over SunSpec because, on information and belief, SunSpec maintains its principal place of business in this District and from that location conducts and/or directs the acts accused of infringement in this action.

5. Venue is proper in this District pursuant to 28 U.S.C. §§ 1391 and 1400(b) because, on information and belief, SunSpec regularly conducts business within this District, has a regular and established place of business in this District, and has committed acts of infringement within this District.

BACKGROUND

6. Tigo has been a leader for many years in developing technology for module-level rapid shutdown of photovoltaic panels.

7. Tigo's products include module-level rapid shutdown units that are attached to photovoltaic panels, such as its TS4-A-F product. The Tigo TS4-A-F works in conjunction with a transmitter, such as the Tigo RSS (Rapid Shutdown System) Transmitter, in order to provide a photovoltaic system that complies with the rapid-shutdown requirements of National Electric Code § 690.12. Tigo's TS4-A-F and RSS Transmitter rapid-shutdown products are pictured below:



8. Tigo has delivered more than 2 million rapid shutdown products to end users.

9. As a result of its pioneering work in developing technology for module-level rapid shutdown of photovoltaic panels, Tigo has obtained multiple patents related to module-level rapid shutdown.

10. U.S. Patent No. 8,933,321 ("'321 patent") is titled "Systems and methods for an enhanced watchdog in solar module installations," and was duly and legally issued by the United States Patent and Trademark Office on January 13, 2015.

11. Tigo is the owner and assignee of all substantial rights in the '321 patent, a copy of which is attached as Exhibit 1.

12. SunSpec promotes itself as an information standards and certification organization for the Distributed Energy Resource industry. Various organizations are members or business partners of SunSpec, including SMA Solar Technology AG ("SMA"), Zhejiang Jiaming Tianheyuan Photovoltaic Technology Co., Ltd. ("JMTHY"), MidNite Solar, Inc. ("MidNite"), and Zerun Co., Ltd. ("Zerun"). SunSpec publicly touts its member companies, including as shown on the SunSpec webisite (https://sunspec.org/members/).

13. National Electric Code § 690.12, "Rapid Shutdown of PV Systems on Buildings," requires that photovoltaic system circuits "installed on or in buildings shall include a rapid shutdown function to reduce shock hazard for emergency responders."

14. SunSpec has published specifications concerning rapid shutdown technology, including the August 21, 2017 Communication Signal for Rapid Shutdown SunSpec Interoperability Specification,

Approved Version 34 (Exhibit 2 to this Complaint, hereinafter the "SunSpec RSD Specification"), and the March 9, 2021 Communication Signal for Rapid Shutdown Test Specification, Version 18 (Exhibit 3, hereinafter the "RSD Test Specification").

15. The SunSpec RSD Specification is intended to meet and support the requirements set forth in the national electric code, including as set forth in NEC 2014, NEC 2017, and UL 1741 relative to module-level rapid shutdown requirements. (Ex. 2.)

16. Tigo's work in the area of module-level rapid shutdown of photovoltaic panels far pre-dates SunSpec. For example, the patent application that led to Tigo's '321 patent was filed in 2009, and was first published in 2010. This was many years before SunSpec began working on the SunSpec RSD Specification.

17. On information and belief, SunSpec developed and publishes the SunSpec RSD Specification with the intent that it be used by its members.

18. On information and belief, SunSpec provides testing and certification for the SunSpec RSD Specification that allows SunSpec members to obtain SunSpec certifications verifying that their products adhere to the SunSpec RSD Specification. To do so, SunSpec establishes relationships with "SunSpec Authorized Test Laboratories" that operate test laboratories in the United States, including Intertek US, Kyrio that operate test procedures under CSA Group, TUV Rheinland US, TÜV SÜD, and Underwriters Laboratories (UL). When a SunSpec member seeks to certify a product, the member pays a fee to SunSpec, and one or more of these SunSpec Authorized Test Laboratories performs the tests required by the RSD Test Specification under SunSpec's direction and control. A report on the testing is then provided to SunSpec, which SunSpec uses to determine whether to certify the member's device as compliant with the SunSpec RSD Specification.

19. As described in more detail below, Tigo told SunSpec that a license to Tigo's '321 patent is needed for products that adhere the SunSpec RSD Specification, and Tigo repeatedly asked SunSpec to inform its members that a license is needed. SunSpec has refused to do so.

20. On information and belief, instead of telling its members that a license to Tigo's '321 patent is needed to use the SunSpec RSD Specification, SunSpec informed its members that they do not need a license from Tigo because the '321 patent is invalid. SunSpec has continued in this conduct,

including by issuing misleading emails to its members, press releases, and social media announcements, despite having received a ruling from the U.S. Patent Office that unequivocally rejected SunSpec's position that Tigo's '321 patent is invalid.

21. In so doing, SunSpec is encouraging SunSpec members whose products adhere to the SunSpec RSD Specification and/or their customers and solar system installers to practice at least claims 1 and 12 of Tigo's '321 patent with the specific knowledge and intent of causing infringement of those claims literally and under the doctrine of equivalents their products are installed and used as they are designed, intended, and certified to be installed and used.

22. SunSpec is also directly and willfully infringing at least claims 1 and 12 of the '321 patent, literally and under the doctrine of equivalents, by directing and controlling SunSpec Authorized Test Laboratories to test SunSpec members' products and by certifying such products as compliant with the SunSpec RSD Specification as described above. In the alternative, SunSpec is actively inducing SunSpec Authorized Test Laboratories to directly infringe at least claims 1 and 12 of the '321 patent by directing and controlling SunSpec Authorized Test Laboratories to perform the tests required by the RSD Test Specification, which involve making and using of a system that practices the SunSpec RSD Specification and thus infringe at least claims 1 and 12 of the '321 patent.

23. Tigo formally notified SunSpec in October 2017 that Tigo owned the '321 patent and that at least claims 1 and 12 of the '321 patent are necessary to the SunSpec RSD Specification.

24. On or about November 1, 2017, SunSpec publicly acknowledged Tigo's notice that claims of the '321 patent are necessary to the SunSpec RSD Specification in a "Member's Briefing." SunSpec publicly repeated that acknowledgment by posting the slides from that meeting on its website at http://sunspec.org/wp-content/uploads/2019/08/RapidShutdown IPbriefing20171101.pdf. A copy of the "Member's Briefing" slides is attached as Exhibit 4.

25. On February 14, 2020, Tigo's attorneys sent SunSpec a letter, explaining that Tigo was willing to license its patents related to rapid-shutdown technology (including the '321 patent) to SunSpec's members on reasonable and nondiscriminatory terms. A copy of the letter is attached as Exhibit 5.

26. Instead of encouraging or facilitating conversations between its members and Tigo,

SunSpec published a "prior art synopsis" (see https://sunspec.org/wp-content/uploads/2021/02/ SunSpec-Rapid-Shutdown-Prior-Art-Synopsis-2021.pdf). SunSpec's "prior art synopsis" document states that its "purpose" is to establish that the technologies involved in the SunSpec RSD Specification were "invented or discovered years or even decades ago and are in the public domain." A copy of SunSpec's "prior art synopsis" document is attached as Exhibit 6.

27. In a letter dated May 20, 2021, Tigo formally notified SunSpec that it was inducing its members to infringe the '321 patent by encouraging them to import, make, use, sell, or offer to sell products adhering to the SunSpec RSD Specification in the United States without a license to the '321 patent. A copy of the letter is attached as Exhibit 7.

28. Tigo's 2021 letter (Exhibit 7) informed SunSpec that Tigo was willing to license the '321 patent to SunSpec members, and that Tigo would be willing to resolve the matter of SunSpec's infringement amicably if SunSpec would notify its members that they need a license from Tigo to import, make, use, sell, or offer to sell rapid shutdown devices that adhere the SunSpec RSD Specification.

29. On or about June 21, 2021, Tigo again notified SunSpec that it was inducing its members to infringe Tigo's '321 patent, and that SunSpec's members needed a license to the same to manufacture, use, import, sell, or offer to sell rapid shutdown devices that adhere to the SunSpec RSD Specification. A copy of the letter is attached as Exhibit 8.

30. SunSpec again declined to encourage its members to obtain a license from Tigo. Instead, in July 2021 SunSpec filed an *inter partes* review ("IPR") proceeding with the Patent Trial and Appeal Board (the "Board") of the United States Patent and Trademark Office (IPR2021-01286) in an effort to invalidate claims of the '321 patent that are necessary to the SunSpec RSD Specification. In the IPR, Sunspec listed several of its members as "Real Parties-in-Interest" to the proceeding.

31. After the IPR was instituted, but long before it was decided, SunSpec issued a press release (see https://sunspec.org/inter-partes-review/). The press release contends that Tigo's '321 patent is invalid and lauds the Patent Office for instituting SunSpec's IPR petition against the '321 patent. A copy of the press release is attached as Exhibit 9.

32. On January 26, 2023, the Patent Office issued a Final Written Decision in SunSpec's IPR. The Final Written Decision is attached as Exhibit 10. The Final Written Decision rejected SunSpec's

invalidity positions, holding that none of the claims that SunSpec challenged in Tigo '321 patent were unpatentable.

33. Notwithstanding this decision, on or about January 30, 2023, SunSpec published a press release titled "Patent Office Invalidates Tigo Energy, Inc.'s Patent Claims" (see https://sunspec.org/patent-office-invalidates-tigo-energy-inc-s-patent-claims/). A copy of this press release is attached as Exhibit 11.

34. Near the end of the press release, SunSpec acknowledged that the Patent Office decided not to invalidate "certain other challenged claims of the … '321 patent":

> The Patent Office ultimately declined to cancel certain other challenged claims of the '770 and '321 patents in its decisions today. SunSpec is still considering its options with respect to these claims, including the possibility of appealing the decisions on those claims.

(Ex. 11.)

35. However, SunSpec failed to acknowledge that the Patent Office decided not to invalidate any claims in SunSpec's challenge against the '321 patent.

36. On information and belief, SunSpec sent out emails providing the content of the press release to all of its members.

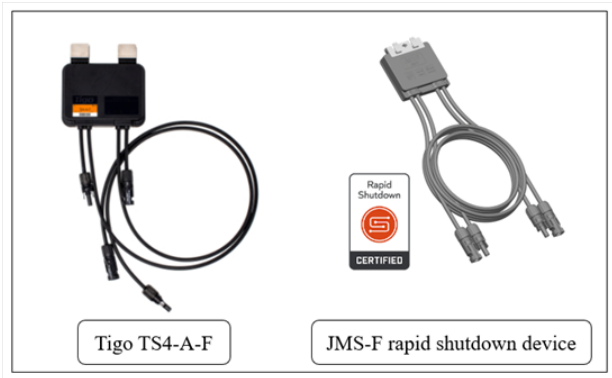
37. On information and belief, SunSpec also made announcements on social media pushing the content of the press release to its members.

38. The January 30, 2023 press release and the communications that SunSpec sent to its members do not suggest that a license from Tigo for the '321 patent is needed to adhere to the SunSpec RSD Specification. Instead, the January 30 press release and the communications that SunSpec sent to its members misleadingly imply that SunSpec was successful in invalidating Tigo's patent claims related to the SunSpec RSD Specification, thereby suggesting that a license to Tigo's '321 patent is not needed.

39. On information and belief, SunSpec and at least some of its members copied Tigo's product line and Tigo's patented technology in developing the SunSpec RSD Specification and in making, using, selling and/or offering for sale products that enable photovoltaic systems to comply with the rapid shutdown requirements of National Electric Code § 690.12 by infringing Tigo's '321 patent. For example, the webpage https://www.sma-america.com/products/sunspec-certified-rapid-shutdown-technology.html states that "SMA inverters paired with SunSpec certified rapid shutdown technology are the simplest,

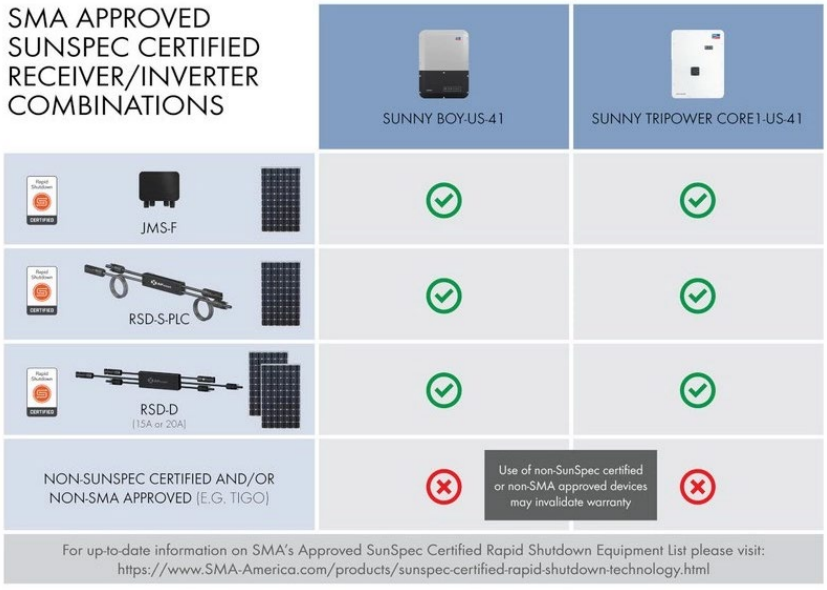
most reliable way to achieve compliance with NEC 2017 while producing more energy than traditional optimizers."

40. As one particular set of examples, SMA's products include the JMS-F rapid shutdown device pictured below right. Like Tigo's TS4-A-F, the JMS-F rapid shutdown device is a module-level rapid shutdown unit that is attached to individual photovoltaic panels.



See, e.g., https://www.sma-america.com/products/sunspec-certified-rapid-shutdown-technology/jms -f-sunspec-rapid-shutdown-device.html.

41. SMA's products also include inverters, including for example the Sunny Boy 3.0-US / 3.8-US / 5.0-US / 6.0-US / 7.0-US / 7.7-US, the Sunny Tripower Core1 33-US / 50-US / 62-US, and the Sunny Tripower X 20-US / 25-US / 30-US ("SMA inverters") which employ "SunSpec rapid shutdown technology" and are specifically designed and advertised to be used in combination with a rapid shutdown device, including the JMS-F rapid shutdown device.



https://www.sma-america.com/products/sunspec-certified-rapid-shutdown-technology.html.

42. Like the Tigo RSS Transmitter, the SMA inverters provide a watchdog signal, e.g., a SunSpec signal, to a rapid shutdown device, e.g., the JMS-F shutdown device, for rapid shutdown along the powerline to enable a photovoltaic system that complies with NEC § 690.12. For example:

- Exhibit 12, JMS-F Rapid Shutdown Box Ver 3.0 Installation Manual ("JMS-F Installation Manual") at 5 ("The signal is transmitted by the inverter with built-in transmitter function through the DC bus. . . . When an emergency situation occurs, the AC power can be turned off by switching the AC breaker in the cabinet, so that the inverter with built in transmitter function stops sending signals, and the JMS-F will shutdown power output . . ."), 10-12;

- Exhibit 13, Sunny Boy 3.0-US / 3.8-US / 5.0-US / 6.0-US / 7.0-US / 7.7-US Datasheet ("Sunny Boy Datasheet") at 3 ("The SMA Energy System Home combines legendary SMA inverter performance and SunSpec certified shutdown devices in one cost-effective, comprehensive package . . . . This rapid shutdown solution fulfills UL 1741, NEC 2014, and NEC 2017 requirements and is certified to the power line-based SunSpec Rapid Shutdown communication signal over DC wires, making it the most simple and cost-effective rapid shutdown solution on the market.");

- Exhibit 14, Sunny Boy 3.0-US / 3.8-US / 5.0-US / 6.0-US / 7.0-US / 7.7-US Installation Manual ("Sunny Boy Installation Manual") at 20 ("A complete PV Rapid Shutdown System consists of the inverter, PV array disconnect switches, and a Rapid Shutdown initiation device. The Rapid Shutdown initiation device serves to initiate a rapid shutdown. The PV Rapid Shutdown System must limit the DC conductors to < 30 V within 30 seconds.").

43. On information and belief, SMA has made, used, sold, offered to sell, imported, installed and/or has had installed the JMS-F rapid shutdown device and/or SMA inverters.

44. Despite knowing that a license to Tigo's '321 patent is required to use the SunSpec RSD Specification, and despite knowing that the Patent Office rejected its IPR challenge to the validity of Tigo's '321 patent, SunSpec has been actively inducing its members to adhere to the SunSpec RSD Specification without obtaining a license to Tigo's '321 patent. In so doing, SunSpec is violating Tigo's patent rights under U.S. patent law, specifically 35 U.S.C. § 271(b), which states that "Whoever actively induces infringement of a patent shall be liable as an infringer."

45. SunSpec is also directly and willfully infringing at least claims 1 and 12 of the '321 patent, literally and under the doctrine of equivalents, by directing and controlling SunSpec Authorized Test Laboratories to perform the tests required by the RSD Test Specification, so as to determine whether to

certify a device as compliant with the SunSpec RSD Specification.

46. The RSD product testing performed under SunSpec's direction and control includes using a system in which a watchdog unit (the "RSD" in the figure below) is coupled between the equivalent of a solar module (the components on the left drawn in black that are connected to the RSD inputs, which are described in the RSD Test Specification as "equipment to simulate the voltage of a PV module") and a power bus, where the power bus is configured to connect a plurality of solar modules to an inverter and a transmitter (the SunSpec signal pattern generator):

An RSD with multiple inputs shall be tested with identical supply circuits connected to its inputs. Figure 3.2 depicts the example of the test setup with a multi-module RSD with two modules.

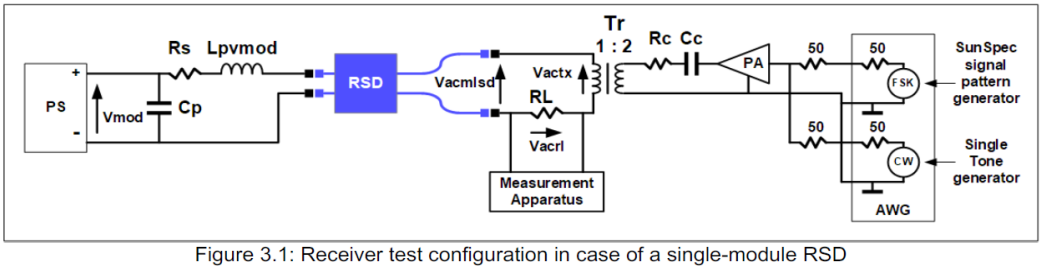


Figure 3.1: Receiver test configuration in case of a single-module RSD

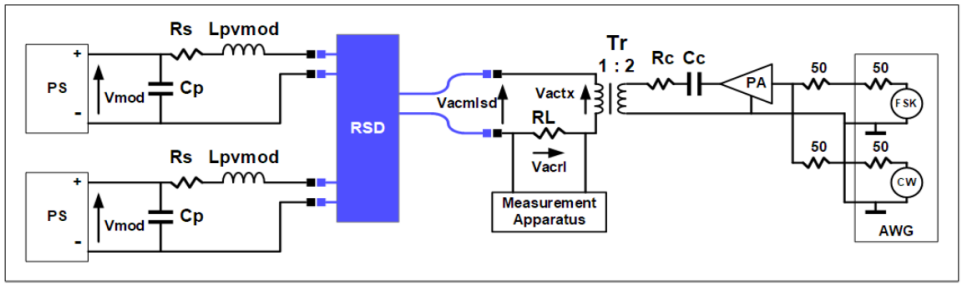


Figure 3.2: Receiver test configuration in case of a multi-module RSD

(Ex. 3 at 7-8.)

47. The RSD product testing performed under SunSpec's direction and control includes using a local controller (in the RSD) configured to monitor a communication (e.g., a SunSpec signal) from a central controller (the SunSpec signal pattern generator) that is remote from the RSD and the solar module or its equivalent and determine whether the communication has been interrupted for a time period longer than a predetermined number of allowed skips as discussed in Count I below.

48. The RSD product testing performed under SunSpec's direction and control includes using at least one switch configured to disconnect the solar module or its equivalent from the power bus (e.g., cause a rapid shutdown) in response to a determination by the location controller that the communication

(e.g., a SunSpec permission-to-operate signal) from the central controller (e.g., transmitter) has been interrupted for a time period longer than the predetermined number of allowed skips as discussed in Count I below.

49. The RSD product testing performed under SunSpec's direction and control includes configuring the solar module or its equivalent to connect to the power bus when the communication is not interrupted as shown in Exhibit 3 and as discussed in Count I below.

COUNT I

(INFRINGEMENT OF U.S. PATENT NO. 8,933,321)

50. Tigo repeats and realleges paragraphs 1-49 as if fully set forth at length herein.

51. On January 13, 2015, the United States Patent and Trademark Office duly and legally issued the '321 patent. Tigo is the owner and assignee of all substantial rights in the '321 patent, including the right to enforce the '321 patent.

52. Each individual claim in the '321 patent recites an independent invention. No individual claim is representative of all claims in the '321 patent.

53. SunSpec has had knowledge of the '321 patent since at least October 2017 when it was informed by Tigo that the '321 patent was necessary to the SunSpec RSD Specification.

54. SunSpec has also had knowledge since at least October 2017 that products adhering to the SunSpec RSD Specification infringe at least claims 1 and 12 of the '321 patent. Despite this knowledge, SunSpec has been directly and willfully infringing Tigo's '321 patent by testing and certifying its members' products as being compliant with the SunSpec RSD Specification, including by directing and controlling the actions of the SunSpec Authorized Test Laboratories as described above. Alternatively, SunSpec actively, knowingly, and intentionally induces direct infringement by SunSpec Authorized Test Laboratories by instructing them to perform tests under the RSD Test Specification, which involve making and using a system practicing at least claims 1 and 12 of the '321 patent.

55. SunSpec has also actively, knowingly, and intentionally induced its members (and their customers and solar system installers) to use the SunSpec RSD Specification, and to make, use and sell products adhering to the SunSpec RSD Specification. For example, SunSpec has published and provided the SunSpec RSD Specification to its members with the knowledge and specific intent that its members

and/or their customers and solar system installers make, use, sell, offer to sell, and import products that adhere to the SunSpec RSD Specification despite SunSpec's knowledge that doing so infringes at least claims 1 and 12 of Tigo's '321 patent, literally or under the doctrine of equivalents.

56. SunSpec has also induced infringement by its members (and their customers and solar system installers) by issuing press releases and disseminating the same to its members in relation to attempts to invalidate claims in Tigo's '321 patent. For example, SunSpec induced infringement by its members (and their customers and solar system installers) through the publication of a "prior art synopsis" that claimed that its "purpose" is establishing that the technology comprising the standard of the SunSpec RSD Specification "was invented or discovered years or even decades ago and are in the public domain." SunSpec knew of Tigo's '321 patent and intended to induce its members to continue infringing Tigo's '321 patent by suggesting that prior art would render Tigo's claims invalid or otherwise unenforceable. As detailed above, SunSpec challenged Tigo's '321 patent in an IPR and failed to show that any claims in the '321 patent were unpatentable.

57. SunSpec's knowledge and intent to induce infringement of the '321 patent is also evidenced by its IPR filing related to the '321 patent and subsequent press releases. After learning of the results of its IPR, SunSpec disseminated a press release to its members touting those results as a victory for SunSpec, as described above. But the Patent Office specifically held that SunSpec failed to demonstrate that any challenged claim in Tigo's '321 patent was unpatentable. Despite full knowledge of this outcome, SunSpec's press release touted the IPR results as a victory for SunSpec. This was egregious given that adhering to the SunSpec RSD Specification without a license from Tigo is infringing conduct. Touting the results of its IPR as a victory for SunSpec intentionally mischaracterizes the result of the IPR on the '321 patent and incorrectly suggests to SunSpec's members (and their customers and solar system installers) that they may adhere to the SunSpec RSD Specification without a license from Tigo.

58. Upon information and belief, SunSpec, and SunSpec members and their customers and solar system installers, have and continue to directly infringe at least claims 1 and 12 of the '321 patent in the United States. In particular, practicing the SunSpec RSD Specification directly infringes the '321 patent, and SunSpec's testing and certification of members' products as being compliant with the SunSpec RSD Specification directly infringes the '321 patent. Below, Tigo shows that (1) practicing the

SunSpec RSD Specification directly infringes claim 1 of the '321 patent, (2) SunSpec directly infringes Tigo's '321 patent by testing and certifying its members' products, such as those of SMA, as being compliant with the SunSpec RSD Specification, (3) SMA directly infringes claim 1 of the '321 patent, as well as other SunSpec's members in a similar manner, and (4) SunSpec induces the direct infringement by SMA and other SunSpec's members.

59. Upon information and belief, SunSpec, SMA and other SunSpec members selling products certified as compliant with the SunSpec RSD Specification, and the customers and solar system installers of products that are certified as compliant with the SunSpec RSD Specification directly infringe at least claims 1 and 12 of the '321 patent under 35 U.S.C. § 271(a), literally and/or under the doctrine of equivalents, by making, using, offering for sale, selling, and/or importing products and systems that practice the SunSpec RSD Specification in the United States.

60. Claim 1 of the '321 patent recites:

> A system comprising:
>
> a watchdog unit coupled between a solar module and a power bus, the power bus configured to connect a plurality of solar modules to an inverter, the watchdog unit having:
>
> a local controller configured to monitor a communication from a central controller remote from the solar module and determine whether the communication has been interrupted for a time period longer than a predetermined number of allowed skips; and
>
> at least one switch configured to disconnect the solar module from the power bus in response to a determination by the location controller that the communication from the central controller has been interrupted for a time period longer than the predetermined number of allowed skips;
>
> wherein the watchdog unit is configured to connect the solar module to the power bus when the communication is not interrupted.

61. Claim 12 of the '321 patent recites:

> a watchdog device coupled between a solar module and a power bus, the power bus configured to connect a plurality of solar modules to an inverter, the watchdog device configured to:
>
> verify communication with a central controller remote from the solar module; and
>
> shutdown the solar module from the power bus if communication with the central controller cannot be verified for a time period longer than a predetermined number of allowed skips.

62. Direct infringement of at least claims 1 and 12 of the '321 patent occurs when SunSpec, SMA and other SunSpec members selling products certified as compliant with the SunSpec RSD Specification, and the customers and solar system installers of products that are certified as compliant

with the SunSpec RSD Specification install, test, make, use, sell, and/or offer for sale solar systems that practice the SunSpec RSD Specification, when SunSpec Authorized Test Laboratories perform the tests required by the RSD Test Specification. On information and belief, SunSpec practices the SunSpec RSD Specification when directing and controlling the testing of its members' products such as those of SMA to certify them as compliant with the SunSpec RSD Specification. In the alternative, SunSpec actively induces SunSpec Authorized Test Laboratories to practice the SunSpec RSD Specification and thus directly infringe at least claims 1 and 12 of the '321 patent by performing the tests under the RSD Test Specification. Practicing the SunSpec RSD Specification involves making and using a system in which a watchdog unit (e.g., a "receiver" in the figure below) is coupled between a solar module (one of the "6-30 PV modules… in series" in the figure below) and a power bus, where the power bus configured to connect a plurality of solar modules (the "6-30 PV modules… in series") to an inverter and a transmitter (which may be separate from or integrated in an inverter):

3.1 System Configuration

A Rapid Shutdown System is a collection of Components and Communication Protocols that are used to fulfill rapid shutdown requirements as defined by NEC 2014 or NEC 2017. Components of a rapid shutdown communication system are Initiator(s), Transmitter(s), and Receiver(s).

The SunSpec Communication Signal for Rapid Shutdown Specification is designed to support rapid shutdown requirements of any PV system governed by NEC 2014, NEC 2017, or applicable UL standard(s), irrespective of system configuration. Issues that commonly affect application protocol performance, such as cross-talk from other protocols, noise, and line impedance, must be accounted for.

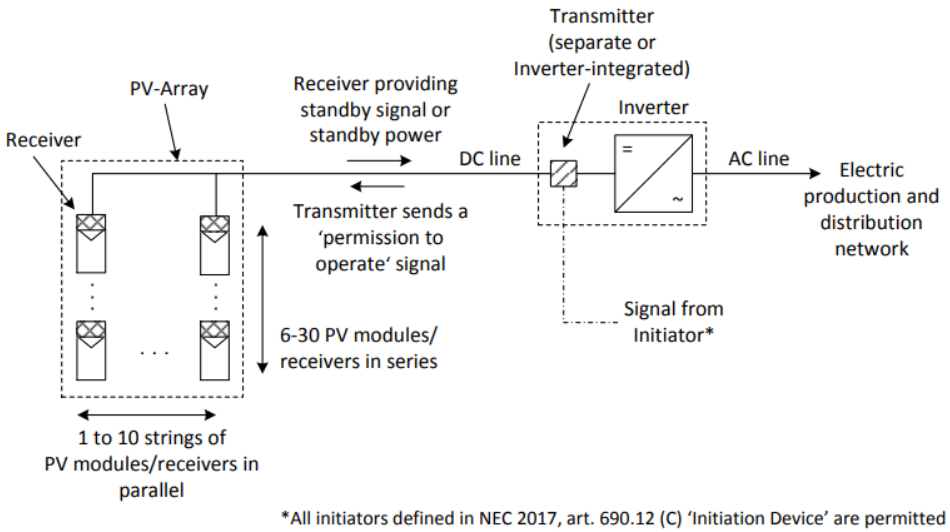


Figure 1: Rapid Shutdown System

(Ex. 2 at 11.)

63. Practicing the SunSpec RSD Specification involves a local controller configured to monitor a communication (e.g., a SunSpec signal) from a central controller (transmitter in Figure 1 of the SunSpec RSD Specification, reproduced above) remote from the solar module and determine whether the communication has been interrupted for a time period longer than a predetermined number of allowed skips:

4.5 Mode Transition Parameters

The following values and parameter ranges are **Requirements** of the Mode Transition attributes of this specification.

Symbol	Mode Specification	Min.	Max.	Unit	Remark
V_{OFF}	PV Power Source voltage in Shutdown	0.6	NA	V	Accommodates % or fixed methods
I_{OFF}	Output current for V_{OFF} tolerance window	10	NA	mA	Requirement
I_{OFFHI}	Output current for V_{OFF} tolerance window for high power option	400	NA	mA	Option
TT1	Time for Initiator to relay to Transmitter	NA	2	s	
TT2	Time for Transmitter to stop permission to operate signal	NA	2	s	
TT3	Time for Receiver to de-energize PV Power Sources	NA	13	s	
TT4	Time for Inverter stored charge to be eliminated	NA	13	s	
TT5	Total time to complete TT1+TT2+TT3+TT4	NA	30	s	
TR1	Time for Receivers to enable PV power generation after compliant KeepAlive signaling commences at the output of the Transmitter.	NA	20	s	Under all expected operating conditions.

Table 1 Mode Transition Parameters

(Ex. 2 at 15.)

5.3 PLC Protocol Requirements

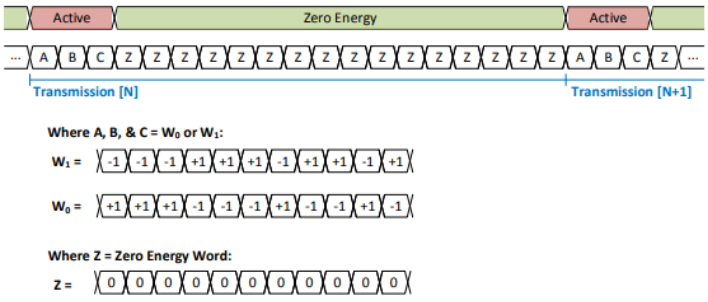


Figure 5: Keep Alive Duty Cycle Timing Diagram

The following values and parameter ranges are **Requirements of the Power Line Communication** attributes of this specification.

(Ex. 2 at 21.)

Symbol	Transmitter Specification	Min.	Nom.	Max.	Unit	Remark
W_1	Logic 1 Code Word	{{-1, -1, -1, +1, +1, +1, -1, +1, +1, -1, +1}				+1 = mark, -1=space
W_0	Logic 0 Code Word	{+1, +1, +1, -1, -1, -1, +1, -1, +1, +1, -1}				+1 = mark, -1=space
Z	Zero Energy Word	{0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0}				0 = zero energy
	Cyclical Transmission	{A, B, C, Z, Z, Z, Z, Z, Z, Z, Z, Z, Z, Z, Z, Z, Z, Z, Z}				A,B,C are W_0 or W_1 Z=zero energy word
	Permission To Operate Code	A B C = W_1 W_1 W_1				Mandatory
	Accelerated Shutdown	A B C = W_0 W_0 W_0				Optional
	Proprietary Use 1 Includes permission to operate	A B C = W_1 W_0 W_1				Optional
	Proprietary Use 2 Without permission to operate	A B C = W_0 W_1 W_0				Optional
	Reserved Includes permission to operate	ABC = W_1 W_1 W_0				Do not use
	Reserved Without permission to operate	ABC = W_0 W_0 W_1				Do not use
	Reserved Without permission to operate	ABC = W_0 W_1 W_1				Do not use
	Reserved Without permission to operate	ABC = W_1 W_0 W_0				Do not use
F_M	Mark Frequency	131.236875	131.25	131.263125	kHz	6.25kHz × 21
F_S	Space Frequency	143.735625	143.75	143.764375	kHz	6.25kHz × 23
T_S	Average Bit Period	5.119488	5.12	5.120512	ms	(Time to complete one full duty cycle)/219
T_T	Transmission Period	168.943104	168.96	168.976896	ms	3 Words
T_Q	Quiet Period	901.029888	901.12	901.210112	ms	16 Words
T_C	Cycle Period	1069.972992	1070.08	1070.187008	ms	19 Words
Z_{TX}	Transmitter Output Impedance	0.05		1.5	Ω	

V_{TX}	Transmitter Output Voltage into >100 kΩ	0.9	1.0	1.1	V r.m.s.	
V_{RXMAX}	Receiver Input Voltage Max	142			mV r.m.s.	
$V_{RXSENSE}$	Receiver Input Voltage Minimum Sensitivity			1.20	mV r.m.s.	118:1 dynamic range
Z_{RXS}	Receiver Line Impedance @ F_S	0.7		1.5	Ω	
Z_{RXM}	Receiver Line Impedance @ F_M	0.7		1.5	Ω	
P_{FALSE}	Probability of false detection					Per SunSpec testing

Table 6 Power Line Communication Values

Table Footnotes:

1. Sequences shall be transmitted in left-to-right order {b1, b2, b3... } means bit 1 followed by bit 2, followed by bit 3 etc.
2. Code words are transmitted continuously in a repetitive, cyclical fashion with no extraneous signaling bits nor additional time delay inserted between them.
3. Code sequences without permission to operate can be sent during a Rapid shutdown initiation while code sequences with permission to operate shall only be sent when an initiator indicates rapid shutdown is not active. If there is no functional indication to use any other code sequence with permission to operate, the code sequence A B C = W_1 W_1 W_1 must be used.
4. Reserved code sequences are for future use by this standard.
5. Receiving a code sequence without permission to operate is not an accelerated shutdown and should be treated like there was no permission to operate signal received.
6. All frequencies and durations are subject to ±100 ppm tolerances on their nominal values at the transmitter.
7. Receivers shall perform within SunSpec specification limits for any long-term frequency deviations at the transmitter that lie within the allowable ±100 ppm tolerance.
8. Receivers may assume that transmitted bit rate and Mark/Space tone frequencies are correlated (*i.e.*, derived from the same original clock source).
9. The receiver line impedance for the mark and space frequency is defined at the input terminals of the device, without the attached wiring under all operating conditions of the device. The specified sensitivity refers to this specified receiver line impedance.

(Ex. 2 at 22-23.)

3.2.2.Receiver in-band interferer rejection

The test shall be performed according to figure 3.1 (or 3.2 for multi-module RSDs). The interfering signal is a CW tone sent with a varying frequency between 120kHz and 155kHz according to table 3.2 and Figure 3.4.

It has to be noted that CW blockers at FM and FS are included in this test. The goal is to test that the architecture of the receiver is immune to any single tone blocking signal right at FS or FM.

(Ex. 3 at 12; *see also* Ex. 3 at 12-13 ("Test-1: ON-state, the RSD must stay ON in the presence of interferer"); Ex. 2 at 19 ("Requirement: Receiver(s) must indicate the absence of permission to operate signals without any false alarms over at least one hundred (100) hours observation period in the presence of a standardized noise and interference test signal as specified in the SunSpec Rapid Shutdown Compatibility Test Plan"); Ex. 2 at 13 ("NEC 2017 specifications require the illuminated PV generators and complete PV system to be de-energized to a maximum when in the Shutdown Mode. Instead of completely zeroing output power capability, the receiver must provide a non-zero output voltage and current within the range offered as allowable by NEC 2017.").

64. As shown above, the cycle period for the permission-to-operate signal is 1.07 seconds, and the time for the receiver to de-energize its PV power sources is 13 seconds. This shows that the SunSpec RSD Specification uses a time period longer than a predetermined number of allowed skips of the permission-to-operate signal. This is confirmed by the requirement that the receiver be immune to any single tone blocking signal and that it operate without any false alarms.

65. Practicing the SunSpec RSD Specification involves having at least one switch configured to disconnect the solar module from the power bus (e.g., cause a rapid shutdown) in response to a determination by the location controller that the communication (e.g., a SunSpec permission-to-operate signal) from the central controller (e.g., transmitter) has been interrupted for a time period longer than the predetermined number of allowed skips:

Receiver	The equipment that is responsible for accepting the communication signal sent by a Transmitter and is capable of initiating a state change of PV power source components based on the signal received. (see Section 3.1 of this document)

(Ex. 2 at 9; *see also* Ex. 2 at 15, 21-23 (reproduced above).)

Receiver

A Receiver is the equipment that is responsible for accepting the communication signal sent by a Transmitter and is capable of initiating a state change of PV power source components based on the signal received.

3.1.5 Requirement: A Sub-system must have at least one Receiver.

Transmitter/Receiver Interactions

Transmitter/Receiver interactions are at the heart of Communication Signal for Rapid Shutdown operation. By optimizing for efficiency and simplicity, low-cost and reliable system solutions are possible.

3.1.6 Requirement: A Transmitter must transmit a permission to operate signal to Receivers when the Initiator indicates rapid shutdown is not active.

3.1.7 Requirement: A Transmitter must stop transmitting a permission to operate signal to Receivers when the Initiator indicates rapid shutdown is active.

3.1.8 Requirement: A Receiver must be able to receive a permission to operate signal and initiate the ability of the associated power-producing equipment to produce power.

3.1.9 Requirement: A Receiver must detect the absence of a permission to operate signal and initiate the shutdown of power production by associated power producing equipment.

(Ex. 2 at 12.)

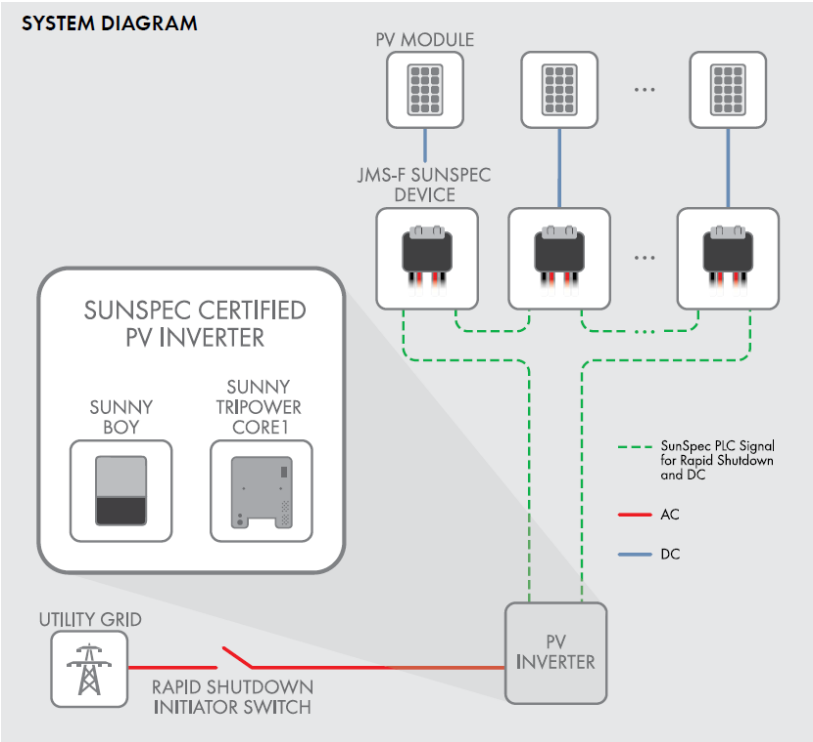
66. On information and belief, practicing the SunSpec RSD Specification involves configuring a solar module to connect to the power bus when the communication is not interrupted as shown in Exhibit 2 and Exhibit 3, including specifically the excerpts cited above describing the

"permission to operate" signal and Exhibit 3 at 12-13 ("Test-1: ON-state, the RSD must stay ON in the presence of interferer").

67. On information and belief, during the process of testing and certifying the compliance of SunSpec's members' products with the SunSpec RSD Specification, such as SMA's products, SunSpec practices the SunSpec RSD Specification by making and using a system covered by at least claims 1 and 12 of the '321 patent to test sample products provided by SunSpec's members to ensure their compliance with the SunSpec RSD Specification. In doing so, SunSpec directly infringes at least claims 1 and 12 of the '321 patent at least by making and using a system that practices every limitation of these claims.

68. The full extent of direct infringement induced by SunSpec is not presently known to Tigo. On information and belief, SunSpec members in addition to SMA have made, used, sold, offered for sale, and/or imported products under different names or part numbers that infringe the '321 patent in a similar manner.

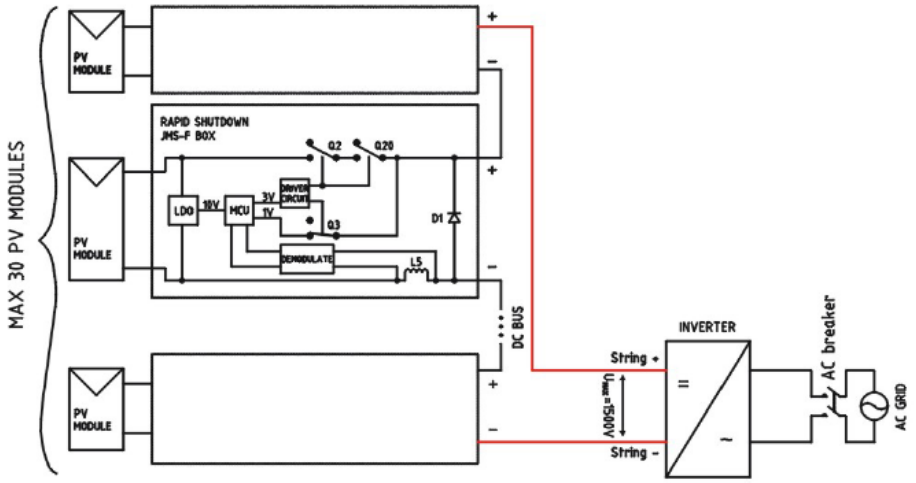
69. As a second non-limiting example of said infringement, on information and belief, the JMS-F device is part of a system in which it is a watchdog unit coupled between a solar module (e.g., PV module) and a power bus (e.g., DC lines shown in green below), the power bus configured to connect a plurality of solar modules to an inverter (e.g., the SMA inverter):



(Ex. 15, JMS-F Datasheet at 2.)

70. On information and belief, the JMS-F comprises a local controller configured to monitor a communication (e.g., a signal such as a SunSpec signal) from a central controller remote from the solar module (e.g., the SMA inverter) and determine whether the communication has been interrupted for a time period longer than a predetermined number of allowed skips:

6. Initiating Rapid Shutdown



When the AC breaker is turned off, the inverter with built-in transmitter function stops sending the signal "permission-to-operate" through the DC bus. JMS-F does not receive the signal and waits for 10 seconds to enter the turn-off mode. Then the MOSFET Q3 is activated and the MOSFET Q2/Q20 is deactivated, the output voltage of JMS-F is 1 Volt, and the PV system is in the no-load state.

Rapid shutdown steps:

STEP1: Switch off the AC breaker on the AC side of the PV system.

STEP2: The inverter with built-in transmitter function stops sending signals, thus initiating rapid shutdown.

STEP3: Each JMS-F does not receive the signal then executing rapid shutdown, the output voltage of each JMS-F is 1 Volt.

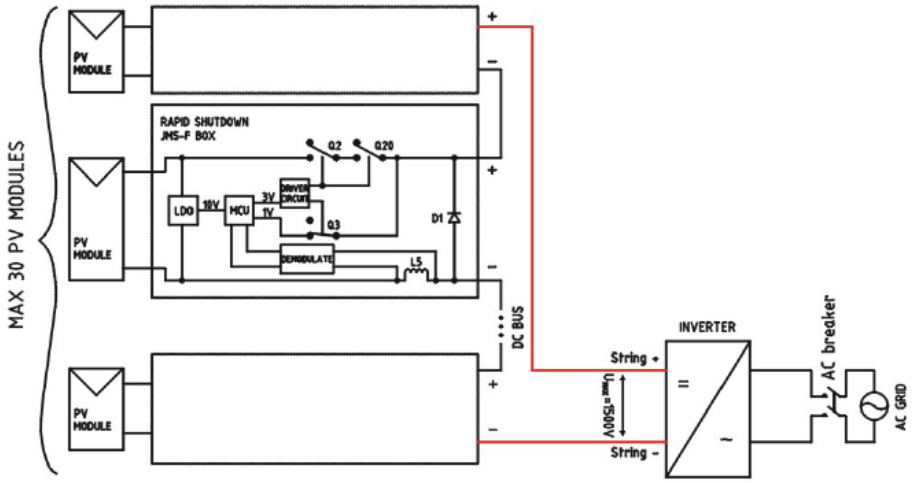
STEP4: At the final stage the DC bus voltage of the PV system drops to below 30 Volts within 30 seconds.

(Ex. 12, JMS-F Installation Manual at 11.)

71. On information and belief, the JMS-F comprises at least one switch configured to disconnect the solar module from the power bus (e.g., cause a rapid shutdown) in response to a determination by the location controller that the communication (e.g., a signal such as a SunSpec signal)

from the central controller (e.g., the SMA inverter) has been interrupted for a time period longer than the predetermined number of allowed skips:

6. Initiating Rapid Shutdown



When the AC breaker is turned off, the inverter with built-in transmitter function stops sending the signal "permission-to-operate" through the DC bus. JMS-F does not receive the signal and waits for 10 seconds to enter the turn-off mode. Then the MOSFET Q3 is activated and the MOSFET Q2/Q20 is deactivated, the output voltage of JMS-F is 1 Volt, and the PV system is in the no-load state.

Rapid shutdown steps:

STEP1: Switch off the AC breaker on the AC side of the PV system.

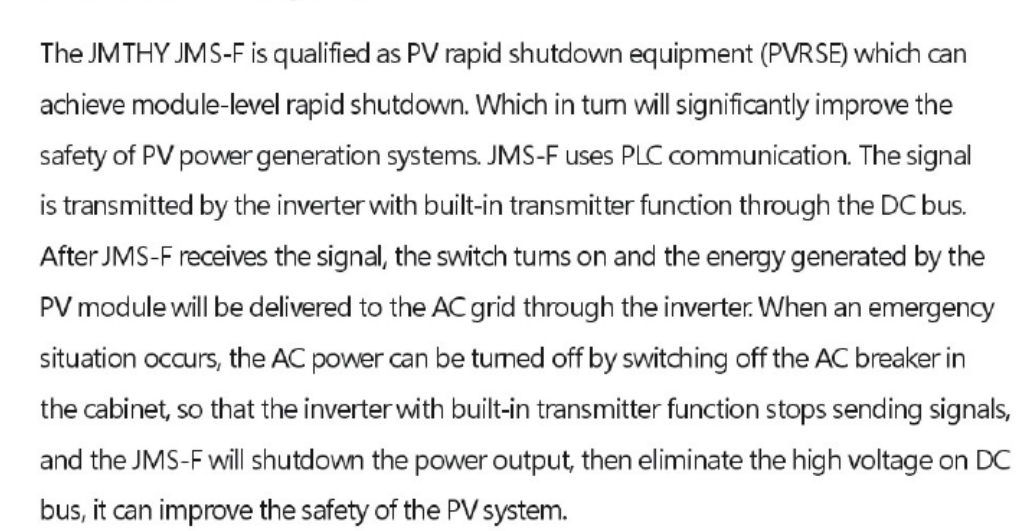
STEP2: The inverter with built-in transmitter function stops sending signals, thus initiating rapid shutdown.

STEP3: Each JMS-F does not receive the signal then executing rapid shutdown, the output voltage of each JMS-F is 1 Volt.

STEP4: At the final stage the DC bus voltage of the PV system drops to below 30 Volts within 30 seconds.

(Ex. 12, JMS-F Installation Manual at 11.)

72. On information and belief, the JMS-F is configured to connect the solar module to the power bus when the communication is not interrupted:



2. Function Description

The JMTHY JMS-F is qualified as PV rapid shutdown equipment (PVRSE) which can achieve module-level rapid shutdown. Which in turn will significantly improve the safety of PV power generation systems. JMS-F uses PLC communication. The signal is transmitted by the inverter with built-in transmitter function through the DC bus. After JMS-F receives the signal, the switch turns on and the energy generated by the PV module will be delivered to the AC grid through the inverter. When an emergency situation occurs, the AC power can be turned off by switching off the AC breaker in the cabinet, so that the inverter with built-in transmitter function stops sending signals, and the JMS-F will shutdown the power output, then eliminate the high voltage on DC bus, it can improve the safety of the PV system.

(Ex. 12, JMS-F Installation Manual at 5.)

73. In the alternative, SunSpec actively induces SunSpec Authorized Test Laboratories to directly infringe at least claims 1 and 12 of the '321 patent by directing and controlling SunSpec Authorized Test Laboratories to perform the tests required by the RSD Test Specification, which involve making and using of a system that infringes at least claims 1 and 12 of the '321 patent, as described above.

74. The full extent of SunSpec's inducement of SMA's infringement is not presently known to Tigo. Additionally, on information and belief SunSpec has induced other SunSpec members to make, use, sell, offer for sale, and/or import products that infringe the '321 patent in a similar manner.

75. SunSpec has known of the '321 patent and intended for its members to infringe the '321 patent by adhering to the SunSpec RSD Specification since at least October 2017. On information and belief, SunSpec offers the SunSpec RSD Specification on its website, SunSpec.org, and announces publicly that they are "part of a library of royalty-free SunSpec Alliance interoperability specifications." By offering the SunSpec RSD Specification, SunSpec provides an open, flexible, scalable, and royalty-free communication framework for manufacturers of photovoltaic system components to be used in a system compliant with the SunSpec RSD Specification SunSpec knows is covered by at least claims 1 and 12 of the '321 patent. SunSpec further tests and certifies its members' products for compliance under the SunSpec RSD Specification and charges its members for such testing and certifications. By offering the

SunSpec RSD Specification, touting its benefits, and by testing/certifying compliance with the SunSpec RSD Specification, SunSpec encourages and specifically intends for its members, such as SMA, to make and use systems that SunSpec knows infringe at least claims 1 and 12 of the '321 patent.

76. Tigo has suffered and continues to suffer damages as a result of SunSpec's infringement of the '321 patent in an amount to be determined at trial.

77. Tigo has suffered and continues to suffer damages as a result of SunSpec's infringement of the '321 patent in an amount to be determined at trial.

78. SunSpec's infringement of the '321 patent is causing irreparable harm for which Tigo has no adequate remedy at law unless SunSpec is enjoined by this Court. Under 35 U.S.C. § 283, Tigo is entitled to a permanent injunction against further infringement of the '321 patent.

79. SunSpec's infringement of the '321 patent is willful and deliberate. SunSpec has been on notice that using the SunSpec RSD Specification infringes and SunSpec has continued to directly infringe and induce infringement by its members and/or their customers and solar system installers despite SunSpec's knowledge that doing so infringes the '321 patent. SunSpec's conduct in inducing infringement is also egregious in light of its posturing and representations to its members regarding the validity of Tigo's patents, including the '321 patent, as detailed above. As SunSpec has no good faith belief that it does not infringe the '321 patent, its continued infringement is willful and deliberate, entitling Tigo to increased damages under 35 U.S.C. § 284 and to attorneys' fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

JURY DEMAND

80. Tigo hereby requests a trial by jury pursuant to Rule 38 of the Federal Rules of Civil Procedure.

PRAYER FOR RELIEF

81. Tigo respectfully requests that the Court find in its favor and against SunSpec and that the Court grant Tigo the following relief:

a. A judgment that SunSpec has infringed Tigo's '321 patent as alleged herein;

b. A permanent injunction against SunSpec and their affiliates, subsidiaries, assignees, employees, agents or anyone acting in privity or concert with them from further

infringement of the '321 patent, including without limitation enjoining the inducement of others to make, use, sell, or offer for sale products or systems that infringe any claim of the '321 patent without a license from Tigo, until the expiration of the '321 patent.

c. A judgment for an accounting of all damages, past and future, sustained by Tigo as a result of the acts of infringement by SunSpec;

d. A judgment and order requiring SunSpec to pay Tigo damages under 35 U.S.C. § 284, including up to treble damages as provided by 35 U.S.C. § 284, and any royalties determined to be appropriate;

e. A judgment and order requiring SunSpec to pay Tigo pre-judgment and post-judgment interest on the damages awarded;

f. A judgment and order finding this to be an exceptional case and requiring SunSpec to pay the costs of this action (including all disbursements) and attorneys' fees as provided by 35 U.S.C. § 285; and

g. Such other and further relief as the Court deems just and equitable.

Dated: April 13, 2023

Respectfully submitted,

/s/ Nicholas Brown

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